Chapter 3: Transportation Systems

This chapter details the various modes that comprise the Wichita Metropolitan Area's transportation systems. These systems provide a means of moving people and goods throughout the region. The systems for the Wichita Metropolitan Area include the highways, streets and roads; public transportation; bicycle and pedestrian facilities; rail transportation and freight movement; and aviation facilities.

Part 1: Highways, Streets, and Roads

Overview

Highways, streets, and roads form the primary transportation system for the region. Currently vehicles travel 11 million miles each day on the planning area's road network. By the year 2030 travel will grow to over 14 million miles per day. As a result, congestion and travel times can be expected to increase. This part of the LRTP identifies issues on those roadways where congestion currently occurs or is expected to occur in the future. An alternatives analysis examines different roadway improvements options and determines their impacts.

Background

Current Road Network

Following the 2000 census and resulting change in the planning area boundary, staff from the Kansas Department of Transportation (KDOT) and the Metropolitan Area Planning Department (MAPD) have been working to update the functional classification of the regions road system and to determine the number of miles in each roadway classification. An estimate of the mileages is given in Table 3.1-1.

Mileage by Functional Classification of Roadway

Roadway Classification	Estimated Number of Miles	
	Urban	Rural
Freeways	59	5
Expressways	69	--
Principal Arterials	185	44
Minor Arterials	433	23
Urban Collectors	283	--
Rural Major Collectors	--	437
Rural Minor Collectors	--	45
Local Roads	1889	1088

Table 3.1-1: Road Mileage by Functional Classification

The planning region is served by numerous Interstate, US, and State highways. I-35 is part of the NAFTA Trade Corridor and carries considerable commercial truck volumes. I-135/US-81 provides a connection from Wichita north to I-70 and on to Nebraska. US-54/400 is an important east-west route from a state perspective and it passes through a number of the cities in the Region. K-96 connects Wichita to the City of Hutchinson. The map in Figure 3.1-1 shows the highway and major road systems.

Highways and Major Roads

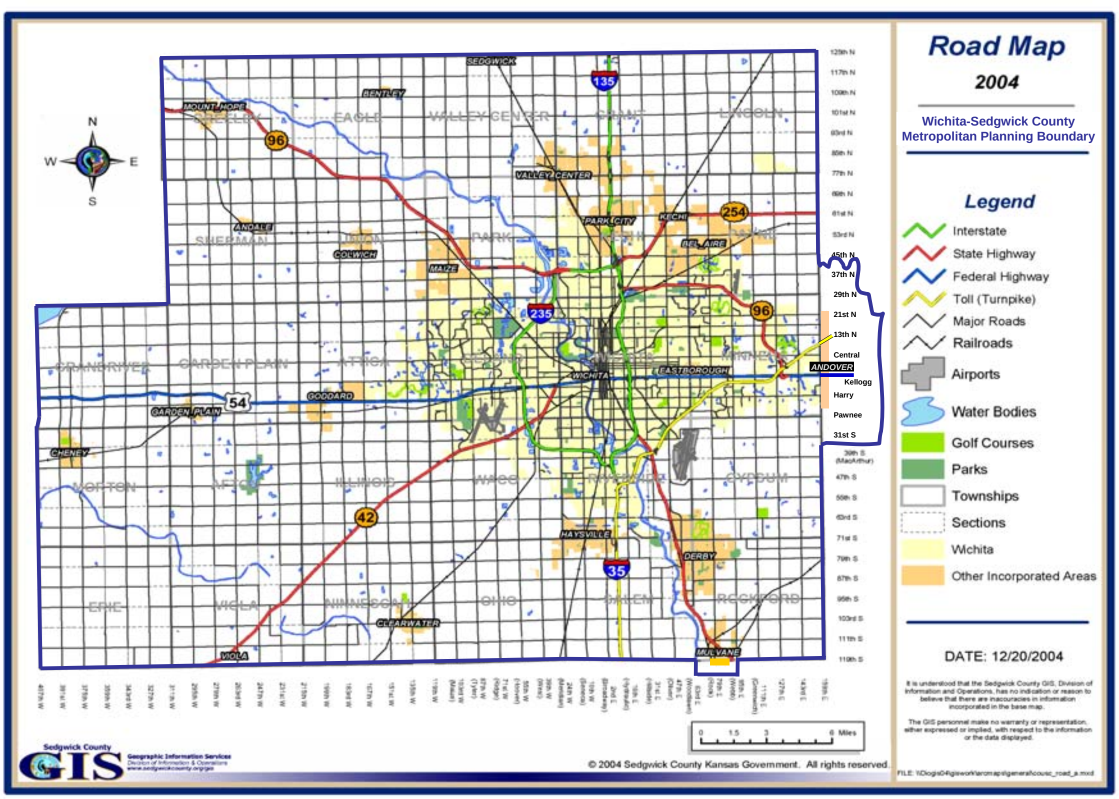


Figure 3.1-1: Highways & Major Roads

Functional Classification of Streets and Roads

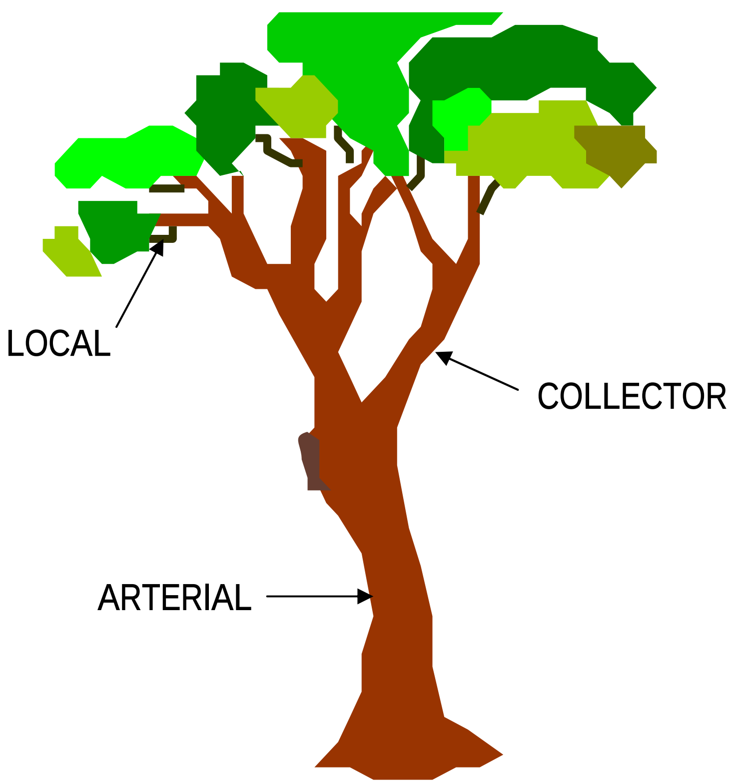
Functional classification is the process by which streets and highways are grouped into classes, or systems, according to the character of traffic service that they are intended to provide. Table 3.1-2 describes the type of service provided by each of the three major roadway functional classifications: arterial, collector, and local roads. All streets and highways are grouped into one of these classes, depending on the character of the traffic (i.e., local or long distance) and the degree of land access that they allow.

Functional Classification of Roads

Functional Classification	Services Provided
Arterial	Provides the highest level of service at the greatest speed for the longest distance, with some degree of access control.
Collector	Provides a less highly developed level of service at a lower speed for shorter distances by collecting traffic from local roads and connecting them with arterials.
Local	Consists of all roads not defined as arterials or collectors; primarily provides access to land with little or no through movement of traffic.

Table 3.1-2: Service Provided by Roadway Functional Classifications

Like the tree shown at the right, streets work as a system collecting and distributing traffic. The tree represents traffic flowing from the outer branches (local roads) to the limbs (collectors) to the trunk (arterials) and back again. Each road has a specific purpose or function. Some provide land access; others provide travel mobility at varying levels, necessary for the longer portions of each trip.



Road classifications are defined as follows:

Freeway: A freeway is a multi-lane, divided arterial roadway with access only at interchanges with major roads. No direct access to adjacent land is allowed. The primary purpose of a freeway is mobility, moving traffic at high speed on long local or regional trips. Examples of a freeway include the Kansas Turnpike (I-35), I-135, I-235, and sections of Kellogg (US-54).

Expressway: An expressway is a multi-lane, divided arterial roadway with access at some at-grade intersections. The primary purpose of an expressway is mobility, with little or no direct access to adjacent land. Examples of expressways include K-96 northwest of Wichita and K-254 from Kechi to El Dorado.

Principal Arterial: Principal arterials are streets and highways that serve major activity centers, carry the highest traffic volumes, and provide for long-length trips.

Minor Arterial: Minor arterials serve to interconnect with the principal arterial system to provide trips of moderate length and to carry lower traffic volumes.

Collector: Collector streets provide the connection between local roads and the arterial road system.

Local Road: Local roads provide direct access to adjacent property. Through traffic is discouraged.

Highways, streets and roads are functionally classified to establish their importance to the overall roadway network, qualification for funding, necessary access control measures, corridor preservation needs, and design standards. A map showing the region's roadway functional classification is shown in Figure 3.1-2.

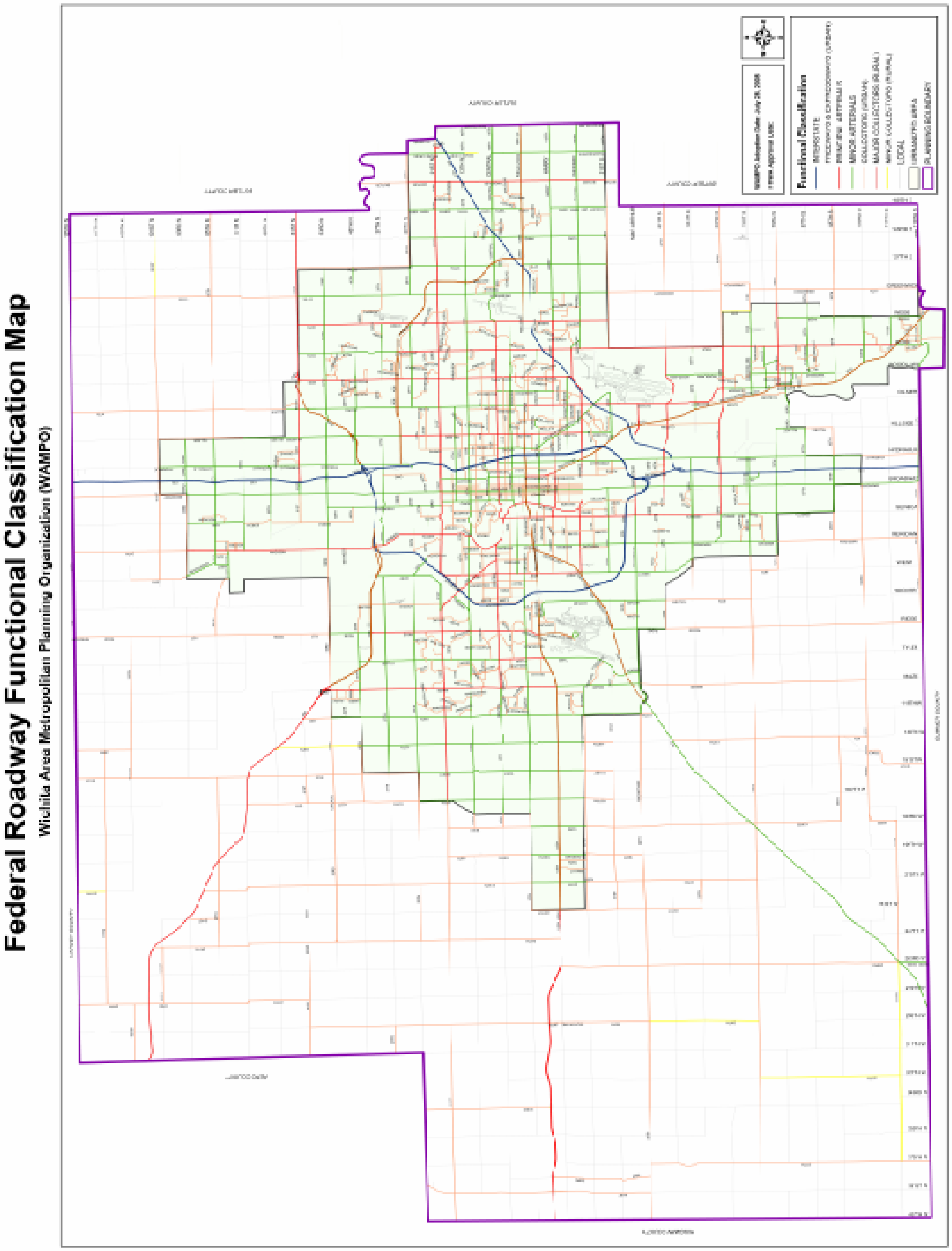


Figure 3.1-2: Roadway Functional Classification Map

Level of Service (LOS)

The performance of a roadway is often stated in terms of Level of Service (LOS). LOS is a measure of the quality of traffic movement and uses a scale from “A” through “F”, where “A” indicates excellent service and “F” represents extremely poor service.

Level of Service Characteristics

Level of Service	Intersections (Average Delay)	Major Streets	Freeways
A	Less than 10 sec. per vehicle	Free-flow conditions Maneuverability is good	Free-flow operations Unimpeded maneuvering
B	>10 and < 20 sec. per vehicle	Reasonably free-flow Maneuvering is slightly affected	Reasonably free-flow Maneuvering is slightly affected
C	> 20 and < 35 sec. per vehicle	Influence of traffic density is noticeable Maneuvering affected	Still need free-flow speed Freedom to maneuver is noticeably restricted
D	> 35 and < 55 sec. per vehicle	Ability to maneuver is severely restricted Speeds are reduced	Speeds begin to decline Freedom to maneuver is limited
E	>55 and < 80 sec. per vehicle	Unstable operations Traffic volumes reach road’s capacity limits	Traffic volumes reach capacity of roadway Little maneuverability
F	> 80 sec. per vehicle	Forced or breakdown traffic flow – Demand exceeds capacity	Breakdowns in traffic flow Demand exceeds the capacity of the roadway

Roadway improvement projects are designed to provide a minimum level of service throughout their design-life, typically 20 years. Improvements should normally provide the minimum LOS of “C” for non-peak hours and at least Level of Service “D” for peak hours. However, in some cases where roadway widening is not possible, LOS “E” will be tolerated as long as any safety issues are mitigated. In these cases alternate measures to reduce congestion will be considered.

For planning purposes, the MAPD uses the following Table 3.1-2 to estimate LOS and the extent of congestion for different types of roads and various numbers of lanes. Traffic volume ranges are correlated to congestion and LOS. These values were used in the travel demand model analyses.

Estimated Level of Service and Congestion

Divided Arterial Streets

Number of Lanes	Light Congestion (LOS C)	Medium Congestion (LOS D)	Heavy Congestion (LOS E)
2	11,500-14,000	14,000-18,000	>18,000
4	23,000-27,500	27,500-36,600	>36,600
6	34,500-41,000	41,000-55,000	>55,000

Undivided Arterial Streets

Number of Lanes	Light Congestion (LOS C)	Medium Congestion (LOS D)	Heavy Congestion (LOS E)
2	10,000-12,000	12,000-14,000	>14,000
3	12,000-15,000	15,000-17,000	>17,000
4	19,000-22,000	22,000-25,000	>25,000
5	24,000-26,000	26,000-30,000	>30,000
6	28,000-34,000	34,000-40,000	>40,000
6/7	31,000-37,000	37,000-45,000	>45,000

Freeways

Number of Lanes	Light Congestion (LOS C)	Medium Congestion (LOS D)	Heavy Congestion (LOS E)
4	42,000-50,000	50,000-66,000	>66,000
6	63,000-90,000	90,000-100,000	>100,000

Expressways

Number of Lanes	Light Congestion (LOS C)	Medium Congestion (LOS D)	Heavy Congestion (LOS E)
4	40,000-50,000	50,000-55,000	>55,000

Table 3.1-2: Estimates of Level of Service/Congestion

Travel Demand Model

Travel demand modeling is the practice of using the travel data, that is the current number of vehicles on the road and the speed they travel, to determine how a transportation network will function. For example, the model can be used to determine the impact of proposed transportation improvements and/or significant land use changes on current and future travel conditions.

The MAPD currently uses QRS II travel demand model, version 6 for traffic forecasting, and has completed a detailed 2002 model validation. This model was used as the base year and was updated to forecast travel for the year 2030 and to analyze a number of alternative improvement scenarios. The technical documentation of the modeling process is available upon request through the WAMPO office.

In long range transportation planning, travel forecasting models are used to estimate the benefits and impacts of different major capital transportation project proposals. In the most basic sense, travel demand models transform forecasts of future population and employment into estimates of travel on a region's transportation system.

While these models vary in specifics the basic structure used in Wichita can be summarized by three principal components.

1. **Trip Generation**: This model step estimates the number of trips produced based upon socioeconomic variables like population, number of households, income, auto ownership, etc. in an area. It also estimates the number of trips attracted to an area based upon variables such as employment by category in an area. Trip productions and attractions are estimated for different purposes such as work, shopping, recreational, etc. The number of productions and attractions are typically estimated using rates by trip purpose developed from local surveys or national sources.

2. **Trip Distribution:** This model step links the trip productions to the trip attractions estimated by the trip generation model. The output of this step is often called an origin-destination (O-D) table because it shows where trips begin and end; e.g., leave home in the morning from a residential area to go to work downtown. The most commonly used method of trip distribution is the Gravity Model; so called because its mathematical form resembles Newton's famous formula. The model links trip origins and destinations so that the resulting distribution of travel times matches an area's known pattern of travel.

3. **Roadway Assignment:** Here the trip O-Ds are allocated to specific roadway facilities that link the origin and destination. There are obviously many ways to get between two points, so the model seeks to minimize everyone's travel time. Equilibrium highway assignment is the state-of-the-practice for this model step. This algorithm iteratively tests different allocations of traffic to routes while re-computing travel times based upon each route's level of congestion. The final solution is an estimate of traffic volume on each road segment such that all trips are satisfied and no trip can switch routes without increasing everyone's travel time.

The MAPD has developed a well refined network representation of the Wichita region's highway system. This network is made up of approximately 1,000 Traffic Analysis Zones (TAZ) that represent a geographical area delineated for transportation analysis. These TAZs range in size from one-quarter square mile in downtown Wichita and highly developed areas to much larger sizes at the edge of the modeled area where development is sparse. The highway network is composed of over 4,000 nodes (representing intersections or where trips enter/leave the system) and 6,000 links that represent all roads in the MPO area from freeways to collectors (plus some local roads in sparsely developed areas at the region's fringe). All in all this is a highly detailed representation of the region's transportation system.

For reference, the specific QRS II parameter settings used for the travel forecasts done in conjunction with the 2030 Long Range Transportation Plan (LRTP) are available upon request from MPO staff as part of the technical documentation for the modeling process.

In a planning context, once the travel demand model has been validated it is ready to be used to estimate how future levels of development and road infrastructure will perform. Forecasting begins with projections of future development; i.e., how many new dwelling units and jobs (the chief determinants of future levels of trip making) there will be in the future. The forecast of trip making is used to test different combinations of road improvements. These "alternative" networks are built upon the validated base year highway network, but reflect changes such as the addition of new roads or the widening of existing roads. Typically, combinations of road infrastructure improvements are packaged and tested as a group rather than individually. The travel demand model estimates how much future travel will occur on postulated future road systems. This information allows comparing how well different combinations and types of improvements contribute to maintaining a region's mobility. Measures such as vehicle miles and hours of travel, level of congestion, travel time, etc. may be derived from the travel model outputs and used in comparing the alternative infrastructures tested. This type of data together with estimates of cost, funds available, citizen acceptance, etc. are all important inputs in selecting the projects that ultimately make up the region's LRTP.

The travel projections derived from these types of models should be viewed as indicative rather than predictive. This is especially true when the forecast horizon is 20 to 30 years in the future. All forecasts have an inherent level of error because the inputs (e.g., the specific location and extent of development) are not known with certainty and the models are a generalization of individual travel behavior. Thus, using the travel demand models as a basis for comparison is the most appropriate application. By using a consistent set of inputs and model specifications, the errors largely cancel out in comparisons. Even though travel demand models are not perfect, they have proven to be the most useful approach to evaluating future travel benefits and impacts

Alternatives Analysis

A set of roadway alternatives were analyzed using the Travel Demand Model (TDM) to determine areas of future congestion and the impacts of various roadway improvements on these areas:

1. 2030 Existing and Committed (E+C)
2. 2030 Existing and Committed plus the planned Northwest Bypass
3. 2030 E+C and the Projects in the Current Wichita Area LRTP
4. Wichita-Valley Center Floodway Crossings
5. Upgrade Existing Expressways to Freeways
6. New Interchange on the Kansas Turnpike (I-35) at 63rd Street South
7. South Area Bypass
8. 21st Street Railroad Grade Separation Sensitivity Test

The results of the travel demand model and analysis for each of the alternatives are discussed below:

1. **2030 Existing and Committed (E+C)**: This network contains the existing highway and major road system and a very constrained set of road improvements. These are almost exclusively road widening projects that are programmed (TIP 2004-08) and funded for construction within the next three years. This alternative shows the expected roadway congestion in the year 2030 if no improvements were made other than those already programmed. This is the base case for comparing the impacts analyzed of other alternatives.

2. **2030 E+C plus Northwest Bypass:** In this alternative a refined alignment for the Northwest Bypass has been added to the E+C network in Alternative 1.

3. **2030 E+C and the Projects in the Current Wichita Area LRTP:** All of the proposed roadway improvements and additions included in the 1999 version of the 2030 Transportation Plan are added to the 2030 E+C plus Northwest Bypass network.

4. **Wichita-Valley Center Floodway Crossings:** This alternative compared different combinations of floodway crossings. These scenarios were created by adding or removing the following elements from the network in Alternative 3.

    a. Crossings at 13th Street, 21st Street, and 29th Street

    b. Crossings at 13th Street and 29th Street

    c. Crossing at 29th Street only

d. Crossing at 13th Street only

e. Crossing at 21st Street only

5. **Upgrade Existing Expressways to Freeways:** Using Alternative 3 as the base model, expressways were changed to freeways for the following route segments:

- US-54 from Webb east to Meadowlark
- US-54 from Maize west to 263rd Street West
- K-42 from I-235 to McArthur
- K-15 from I-135 to 63rd Street South
- K-254 from Woodlawn to east of Andover
- K-96 from Maize to 167th Street West

6. **New Interchange on the Kansas Turnpike (I-35) at 63rd Street South:** Using Alternative 3 as the base model, a new full interchange on the Kansas Turnpike at 63rd Street South was modeled. Three scenarios were considered:

   a. Existing operation with only the existing interchange at 71st Street

   b. A new interchange at 63rd Street and no interchange at 71st Street

   c. Interchanges at both 63rd Street and 71st Street

7. **South Area Bypass:** A new freeway facility in the south half of the urban area from US-54 and the propose Northwest Bypass on the west to US-54 and K-96 on the east, generally outside the urban area and passing between Derby and Mulvane as a possible scenario. At this time this is not the final option, nor may it be a final option. This scenario was used because specific alignments must be designated in the modeling process.

8. **21st Street Railroad Grade Separation Sensitivity Test:** In this alternative the network is modified to reflect the physical separation between rail lines and the roadways.

Regional Needs

A number of regional needs were identified through stakeholder interviews, comments during the public meetings, and analysis of the forecasted future traffic volumes. The major issues include:

- The need for additional east-west streets crossing the Wichita-Valley Center Floodway to ease the traffic load on current roadways.

- The need to study the southern portion of the metropolitan area to determine if transportation improvements are needed to improve mobility. If a bypass is recommended the study needs to determine the alignment and right-of-way requirements for such a route.
- The need to maintain good access for communities in the metropolitan area both to the highway system and between each other. This will require the implementation of corridor management practices to control the number and location of access points along these routes.
- Capacity improvements are needed on some highways and major roads.
- US-54 should be upgraded to a freeway across Sedgwick County and through the City of Andover.
- Improve the interchanges along I-135 and I-235 to relieve congestion and to improve safety.
- Study the impacts of proposed developments in downtown Wichita.

The complete list of suggested needs and other comments received from the public and other transportation stakeholders can be found in Appendix A.

Recommendations

Planning Studies

Planning studies are useful in many situations to analyze the impacts of specific transportation improvements on the region and/or a more focused area. These studies will analyze the traffic impacts of proposed developments on the road network, the impacts of improvement alternatives, and the impacts on the community.

South Area Transportation Study: Federal funds have been dedicated for a South Area Transportation Study (SATS) of the southern part of the metropolitan area. Many of the cities in this area are interested in the potential to improve mobility and access to this region. New major roads or improvements to existing roads can have a significant economic impact on the surrounding area through improving regional access, encouraging new development, and providing the opportunity for rejuvenating the area. The study should begin in Fall 2005 and should determine the benefits of a transportation improvements, their impacts on land use, and possibly a preferred alignment and right-of-way requirements.

I-235 with Kellogg (US-54/400) and Central: The I-235 interchanges with Kellogg (US-54/400) and Central Avenue are to be studied to determine future improvement needs, interim and ultimate improvements, and the impact of those improvements on the community. This study should also consider the impacts of various crossings of the Wichita-Valley Center Floodway as analysis has shown that additional floodway crossings will impact the volume of traffic on Central and to some extent on Kellogg.

Interchange Studies: Studies should be considered for other interchanges along both I-135 and I-235. In particular, the interchange of I-135/I-235/K-96/K-254 and the interchange of I-135/I-235/KTA should be reviewed for warranted traffic operation improvements.

Downtown Wichita: Transportation/traffic impact studies of the proposed downtown arena and potential surrounding neighborhood redevelopment are scheduled to be completed within the next year. Results of these studies should be reviewed and the findings compared with the LRTP.

Kellogg (US-54/400)

Efforts should continue to upgrade Kellogg (US-54/400) to a freeway across Sedgwick County and through the City of Andover in Butler County. Highway US-54/400 is a major east-west corridor through southern Kansas and carries a significant amount of commercial truck traffic as well as overall traffic volumes.

Wichita-Valley Center Floodway

A number of alternatives were analyzed to resolve the traffic barrier created by the floodway. New crossings at 13th Street and 25th Street are recommended.

Congestion on Streets and Roads: A number of streets and roads in the planning area are congested each day during peak traffic periods. The travel demand model has been used to analyze congestion and the results have been used in developing the recommended roadway improvement projects. The congestion management policy and a criteria-based project selection process should be followed to identify projects to be included in the TIP.

Access Control/Corridor Management

Access management/control protects the mobility function of a roadway and provides for the safe movement of traffic. Key corridors such as those connecting cities in the metropolitan area are good candidates for access management. The roadways proposed for "corridor protection" were shown in the previous LRTP and this concept is again recommended in the 2030 LRTP and expanded to cover the new planning area. Figure 3.1-5 shows the roads within the planning area that have been identified for corridor protection. Access to properties fronting these key transportation corridors can generally be provided from side streets. In some cases frontage roads may need to be constructed. This recommendation should not affect existing driveways and entrances.

Corridor Protection
Using Partial Access Control (Proposed)

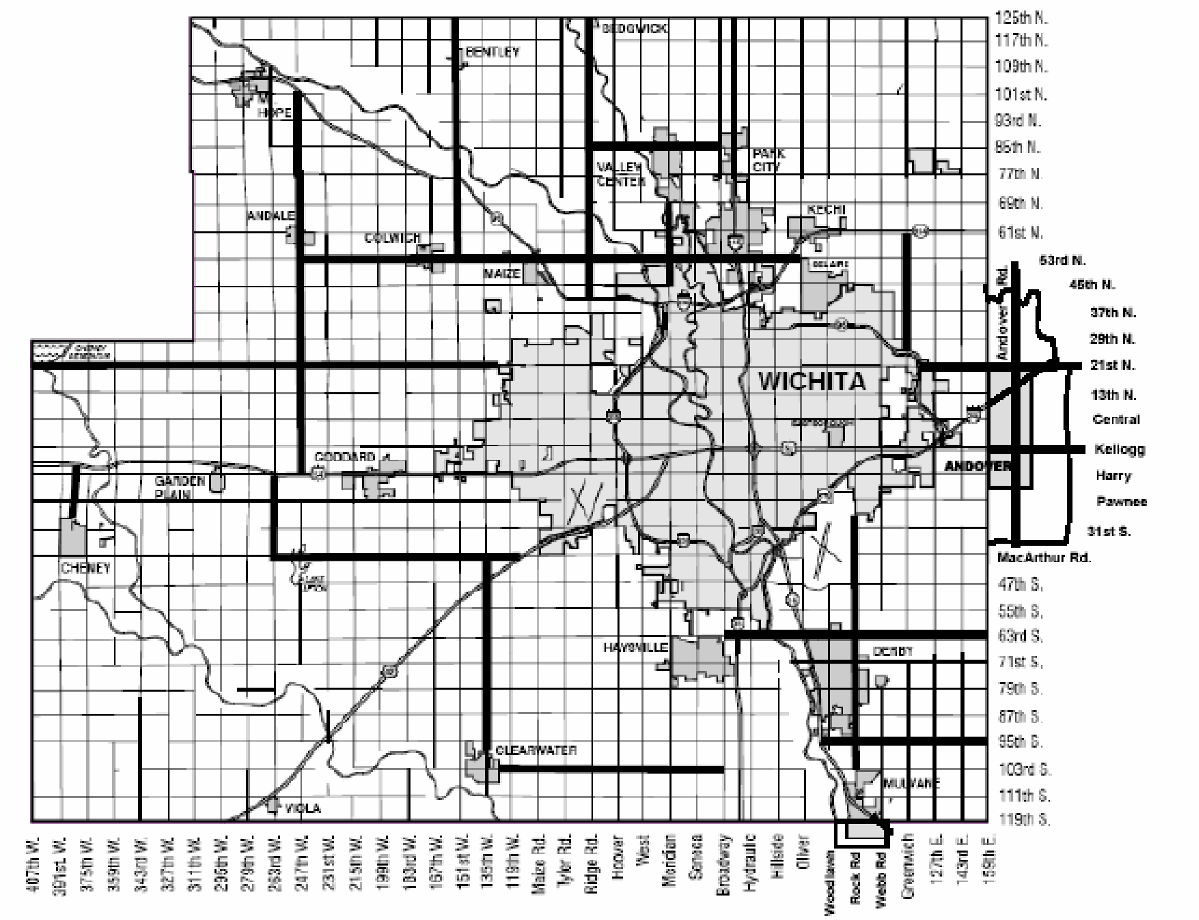


Figure 3.1-3: Roadways Identified for Corridor Protection

Summary

Highways, streets, and roads provide the primary transportation system for the planning area's residents and visitors. Comments received through the public and stakeholder involvement process identified key roadway and traffic operation issues. These issues were considered during the analysis of the roadway system. Many roadways are currently experiencing some level of congestion. With the expected growth in traffic through the year 2030, a travel demand model was prepared and used to analyze future roadway congestion and improvement alternatives.